

MARINE DIESEL SPECIALISTS, INC
SURVEY REPORT

September 5, 2024

Zachary Hayes
10340 N. 84th Street
Omaha, N.E. 68122

M/Y “ICE BEAR” 52M (167ft) FEADSHIP DE VRIES HULL# 732372

MAIN ENGINES:

CAT 3512 DITA 1175 HP at 1600 RPM

Port Engine Number : 50Y00712 Hours: 12,195 + 22,000 before rebuild

Stbd Engine Number : 50Y00711 Hours : 12,168 + 22,000 before rebuild

Marine Gear: REINTJES WAV840 Port: 52565 Stbd: 52566 Reduction: 3.950/1A

DESCRIPTION

The CAT 3512 DITA is a twelve-cylinder V configuration engine. The cylinder bore diameter is 170 mm (6.7 “) with a stroke of 190 mm (7.5”) with a total displacement of 51.8L. The engine is of a four-cycle design with mechanical governing and injection, closed circuit liquid cooling, charge air cooling and exhaust turbochargers. Single cylinder heads with two exhaust valves and two intake valves per cylinder are some of the design features of this engine.

Charge air cooling is accomplished through the large cooler that is mounted in the valley of the engine. Charge air cooling serves to make the combustion air more dense which enables the engine to efficiently burn more fuel and therefore, increasing the horsepower output when combined with exhaust gas driven turbochargers. The turbochargers are mounted at the end of each exhaust manifold, and they pressurize and deliver combustion air to the engine. Both the exhaust manifolds and the turbochargers are jacket water cooled.

The cooling system consists of tube bundle type heat exchangers which are supplied seawater by an engine mounted, gear driven raw water pump. The fuel injection system is mechanically controlled, and fuel is delivered via high pressure through the injectors and into the combustion chamber. This serves to reduce smoke and noise commonly associated with other direct injection engines.

Engine starting is accomplished through two 24-volt Delco MT 50 starter and batteries are charged by an engine belt driven 24-volt CAT alternator. This engine application is typical for full displacement yachts, trawlers, towboats, crew and supply boats. Cruise speed should be approximately 1200 RPM according to Caterpillar.

234 SW 32ND Street, Fort Lauderdale, FL 33315
www.marinedieselspecialists.com

MAIN ENGINE PERFORMANCE

A sea trial was performed, and the engines were slowly brought up to 1000 RPM in order to allow pressures and temperatures to stabilize. Pressures were within normal parameters for this engine application at that speed while temperatures were slightly elevated. The engines were next brought up to 1200 and 1400 RPM, again temperatures were elevated, and pressures were within manufacturers specifications. The engines were then brought up to maximum RPM of 1462 on the port and 1525 on the starboard with pressure readings being normal and coolant temperatures showing overheat levels. Maximum full load RPM should be 1600. The engines did not reach full load RPM. It is necessary to bring the engines to maximum RPM on occasion in order to check performance and to check for problems that otherwise may not be evident at lower engine speeds.

FUEL SYSTEM

Fuel is supplied to the engines from the tanks through triple Racor model 79/1000 MAV primary filter assemblies that act as primary filters and water separators. The fuel is routed from the primary filters to the engine supply pump then through engine mounted double cartridge type secondary fuel filters and on to the injector nozzles. The Racor assemblies have no leaks and look in good condition at this time.

COOLING SYSTEM

The engine cooling system consists of tube bundle type heat exchangers mounted forward of the engines under the deck plates. The heat exchanger cools the engine coolant circuit. Seawater is supplied to the heat exchangers through a bronze impeller gear driven pump mounted at the front of the engine. The after coolers are fresh water cooled. Zinc anodes are used in the CAT cooling system. Periodic inspection of sea strainers, water pump impellers, zinc anodes, and heat exchangers is recommended. The coolant temperatures were elevated during the sea trial.

MARINE TRANSMISSION: REINTJES WAV840

The marine transmissions are manufactured in Germany. The housing is made of a light aluminum alloy and the internal parts include an input shaft, output shaft, gears, and forward and reverse clutch packs. The gear is hydraulically operated and is a reduction and a reversing unit. The selector valve serves to direct oil flow to provide neutral, forward or reverse. The transmissions operated normally during sea trials and there was no slippage noted during operation. The transmissions are equipped with a dual cartridge filter assembly and a seawater cooled oil cooler both of which should be removed and cleaned periodically. The transmissions are free standing, and the engines are set up in a conventional propulsion configuration. The transmissions have a reduction ratio of 3.95/1. The port gear oil cooler has a oil leak at the filter housing fitting.

EXHAUST SYSTEM

The vessel is equipped with a marine exhaust system that consists of a single riser per engine. The hot sections of the risers are shielded with a soft fiberglass wrap. The exhaust stream exits the hull in the engine room after meeting a raw water inducted collector and spray ring for cooling. The exhaust bypass exits the hull at the port and starboard hull sides at the waterline. This is designed to prevent back pressure. The bypasses feature electronically controlled valves that open and close depending on engine RPM. The exhaust system is in good condition with no leaks noted at the time of sea trial.

MOUNTS

The engines are resiliently mounted on Rubber Design mounts. There are four mounts per engine. The mounts are 50 shore hardness chock-fastened directly to the stringers. The mounts appear to be in good condition as there was no movement noted during sea trials or maneuvering.

ELECTRONICS

The vessel's helm is equipped with electric gauges featuring engine parameters such as engine RPM, engine oil pressure, engine coolant temperature, gear oil pressure, and shaft speed. The engine room features the standard caterpillar monitoring package featuring gauges for RPM, coolant temperature, oil pressure, gear oil pressure, and gear oil temperature, air restriction and fuel pressure. The local operating panels on the engines also feature start-stop capabilities. All engine gauges are functioning properly at this time.

PREHEATERS

Both port and starboard engines are equipped with coolant preheat assemblies manufactured by KiM Hotstart. They are designed to prevent cold start up and prolong engine life. The preheat assemblies are 220-volt AC. There are two preheat elements per engine. Both port and starboard preheaters are functioning properly at this time.

STARTER / ALTERNATOR

The engines are equipped with 24-volt starters and alternators. The engines have two Delco MT 50 starters per unit and a single CAT 24-volt belt driven alternator. The drive belts on both the port and starboard are in good condition at this time. The output voltage on the alternators is 27 volts. Both the alternators and starters are functioning properly at this time.

CONTROLS

The vessel is equipped with fly by wire electronic controls. The controls feature single lever control for port and starboard and are manufactured by Aventics. The vessel is equipped with five control stations a helm station, port wing station, starboard wing station, forward and aft crows nest. There are also emergency controls in the engine room. The control stations also feature Aventics type 230 TFT digital control displays with actuation indicators and RPM. The control heads feature push button functions for synchronization and command. The control stations also feature push buttons for start and stop of the engines. All five control stations are functioning properly at this time.

AIR FILTRATION

The combustion air is supplied to the engines through CAT paper element air filters mounted directly to the air inlet elbow of the turbocharger. This application utilizes engine room air supply. The filters were in good condition at the time of survey, and it appears like they were recently replaced.

MANUFACTURER’S RECOMMENDATIONS

CAT recommends that the engines be serviced at 1000-hour intervals changing engine oil, filters, primary and secondary fuel filters. In addition, a maintenance service that includes additional items should be performed at 500-hour intervals. A maintenance schedule is onboard the vessel for review.

DISCREPANCIES MAIN ENGINES

PORT

1. Oil leak at the base of the governor head.
2. Oil seep noted outboard on oil pan. Possible oil plug.
3. Left bank #4 cam cover leaking oil.
4. Back side of front housing leaking oil left bank.
5. Gear cooler seeping oil from fitting.
6. Gear cooler raw water hoses are cracking, and clamps are rusty.
7. Gear filter housing fittings seeping oil.
8. Engine room digital tach is not accurate.
9. Oil prelube pump is leaking.
10. Engine coolant temperature was elevated during trial run.

STARBOARD

1. Gear cooler raw water hoses are cracking, and clamps are rusty.
2. Left bank cam covers are leaking oil.
3. Back side of front housing leaking oil left bank.
4. Left bank #2 valve cover leaking oil.

STARBOARD (continued)

5. Right bank #3,5, and 6 cam covers are leaking oil.
6. Flywheel housing tach drive is leaking oil.
7. Engine room digital tach is not accurate.
8. Engine coolant temperature was elevated during trial run.

GENERAL COMMENTS

The main engines and gears were found to be in good condition at this time. An external visual inspection was performed to show the outward appearance of the main engines and marine gears are satisfactory. However, both port and starboard engines cooling system is in need of maintenance service at this time. The above discrepancies should be remedied at the next service period. The main engines were overhauled at approximately 22,000 hours and the engine hour gauges were replaced at that time.

GENERATORS**2 X NORTHERN LIGHTS 145KW**

PORT	STARBOARD
Model: M1066A2-145	Model: M1066A2-145
Serial: 0662-39953	Serial: 0662-39954
Hours: 40,382	Hours: 14,292
KW: 145	KW: 145
KVA: 181	KVA: 181
Volts: 120/208Y	Volts: 120/208Y
Amperage: 503	Amperage: 503
RPM: 1800	RPM: 1800
Freq: 60 htz.	Freq: 60 htz.
Oil press: 48 PSI	Oil press: 48 PSI
Coolant temp: 181 F°	Coolant temp: 178 F°
Batt. V: 27.3	Batt. V: 26.6

The generators are resiliently mounted to their frames and all mounts appear to be in good condition. The generators have a Murphy monitoring system in the engine room that monitors operating parameters along with oil level and coolant level. The main generators are equipped with dual Racor 900 filter assemblies with the bowls clean and clear.

The generator units were replaced in 2006 and overhauled at 3946 hrs. on port and 3216 on stbd. Both generators have engine block heaters that function properly at time of survey.

GENERATOR DISCREPANCIES

PORT

1. Coolant cap needs replacement.
2. Heat exchanger has epoxy repair. Clean and inspect.

STARBOARD

1. Coolant cap needs replacement.
2. Turbo compressor housing leaking oil.
3. Oil seep on oil pan.

OIL SAMPLE RESULTS

The oil sample results are included in this report. All machinery falls within normal wear limits with no external contamination and proper performance of lubricants.

NOTE:

The comments as stated in this report are based on engine inspections that were performed to the best of our ability and with as much attention to detail as possible. The results are believed to be an accurate evaluation as to the general condition of the engines at this time.

However, Marine Diesel Specialists, Inc. offers no warranty either express or implied on the engines of M/Y "ICE BEAR". Survey results are intended to represent the physical condition of the vessel only on the day of the survey, based on the facts presented and discovered, in the opinion of the surveyor. This report will not specify or imply any type of warranty of the vessel or the vessel's machinery.

This report is issued subject to the condition that it is understood and agreed that neither this office, nor any surveyor or employee thereof is under any circumstances whatsoever to be held responsible in any way for any error in judgment, default or negligence, nor for any inaccuracy, omission, misrepresentation or misstatement in this report, and that the use of this report shall be construed to be an acceptance of the foregoing conditions. This report is issued without prejudice to the rights of whom it may concern.

Thank you for the opportunity to be of service and if you have any questions, please call.

Sincerely,

Peter Angel
President

Marine Diesel Specialists Sea Trial Data Port

BOAT NAME: **ICE BEAR**

GEARBOX TYPE: **REINTJES**

NAME: **THOMAS**

ENGINE TYPE: **CAT 3512 DITA**

GEARBOXNR: **525665**

DATE: **SEPT. 5, 2024**

ENGINE NR: **50Y00712**

LOAD CONDITION: **50%**

WEATHER: **P/C**

OPERATING HOURS: **12,195+22,000**

LOCATION: **WEST PALM**

SEAS: **2-3**

Engine Speed	R P M	800	1000	1200	1400	1600
Eng. Speed Actual	R P M	804	1001	1202	1394	1461
Outside Air	Deg F ^o	91	91	91	91	91
Air Before Turbo	Deg F ^o	96	98	103	96	95
Charge Air Temp	Deg F ^o	170	175	179	180	180
S.W. Aft. Pump	Deg F ^o	85	87	87	88	88
F.W. Temp	Deg F ^o	185	180	192	199	200
Exhaust Temp A	Deg F ^o	450	590	730	850	899
Exhaust Temp B	Deg F ^o	490	580	730	850	899
Engine Oil Press	PSI	60	60	61	61	61
Charge Air Press	PSI	0	0	6	9.5	12
Fuel Pressure	PSI	48	59	62	64	65
Gear Oil Press	PSI	200	210	210	215	215
Gear Oil Temp	Deg F ^o	115	120	125	130	137

Marine Diesel Specialists

Sea Trial Data STBD

BOAT NAME: **ICE BEAR**

GEARBOX TYPE: **REINTJES**

NAME: **THOMAS**

ENGINE TYPE: **CAT 3512 DITA**

GEARBOXNR: **525666**

DATE: **SEPT. 5, 2024**

ENGINE NR: **50Y00711**

LOAD CONDITION: **50%**

WEATHER: **P/C**

OPERATING HOURS: **12,168+22,000**

LOCATION: **WEST PALM**

SEAS: **2-3**

Engine Speed	R P M	800	1000	1200	1400	1600
Eng. Speed Actual	R P M	803	1004	1202	1398	1532
Outside Air	Deg F ^o	91	91	91	91	91
Air Before Turbo	Deg F ^o	96	99	103	105	95
Charge Air Temp	Deg F ^o	172	175	180	181	185
S.W. Aft. Pump	Deg F ^o	85	87	88	88	89
F.W. Temp	Deg F ^o	185	195	200	205	210
Exhaust Temp A	Deg F ^o	450	610	750	825	875
Exhaust Temp B	Deg F ^o	440	590	710	850	875
Engine Oil Press	PSI	59	60	60	61	61
Charge Air Press	PSI	0	0	6.5	9	12.5
Fuel Pressure	PSI	60	60	60	62	62
Gear Oil Press	PSI	230	245	250	250	270
Gear Oil Temp	Deg F ^o	115	120	125	130	137

Marine Diesel Specialists Cylinder Pyrometer

BOAT NAME: **ICE BEAR**

GEARBOX TYPE: **REINTJES**

NAME: **THOMAS**

ENGINE TYPE: **CAT 3512 DITA**

GEARBOXNR: **52565/52566**

DATE: **SEPT. 5, 2024**

ENGINE NR: **50Y00712/50Y00711**

LOAD CONDITION: **50%**

WEATHER: **P/C**

OPERATING HOURS: **12195/12168**

LOCATION: **WEST PALM**

SEAS: **2-3**


		P O R T				S T A R B O A R D			
Engine Speed	RPM	1000	1200	1400	1600	1000	1200	1400	1600
Engine Speed Actual	RPM	1004	1202	1394	1462	1001	1202	1398	1525
Cylinder 1	Deg F ⁰	666	841	970	1005	672	848	999	1120
Cylinder 2	Deg F ⁰	650	825	974	1010	670	849	1000	1120
Cylinder 3	Deg F ⁰	655	840	983	1028	676	852	1014	1117
Cylinder 4	Deg F ⁰	656	840	985	1027	688	851	992	1080
Cylinder 5	Deg F ⁰	655	847	987	1020	677	847	988	1116
Cylinder 6	Deg F ⁰	652	850	986	1030	678	868	1008	1075
Cylinder 7	Deg F ⁰	653	849	1003	1037	672	847	1007	1078
Cylinder 8	Deg F ⁰	649	842	980	1023	673	854	992	1099
Cylinder 9	Deg F ⁰	652	841	976	1018	673	846	984	1076
Cylinder 10	Deg F ⁰	653	834	978	1022	653	832	968	1062
Cylinder 11	Deg F ⁰	645	834	952	991	645	830	946	1048
Cylinder 12	Deg F ⁰	637	805	947	987	645	826	948	1073

MARINE DIESEL SPECIALIST Phone: Email: Fax: - - -	Machine ID: ICE HEAR Machine Year : NA	Component ID: 066239953 Component Make: NORTHERN LIGHTS Component Model: M1066A2 Component Year: NA Component Type : DIESEL ENGINE Component Location: PORT GENERATOR Sump Capacity: 5 Gallons	MOTOR CHECK ANALYSIS CLINIC 2000 N FLORIDA MANGO RD SUITE 104 WEST PALM BEACH FL 33409 561-684-7799
Component Description:			

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
54888	9/6/2024	40382	100	15W40	UNKNOWN	UNKNOWN	No	9/6/2024	
Comments	ALL ENGINE WEAR RATES NORMAL. SAMPLE APPEARS FREE OF EXTERNAL CONTAMINATION. ANALYSIS INDICATES PROPER PERFORMANCE OF THE LUBRICANT AND UNIT.								

Sample ID	Wear Metals(ppm)							Contaminant Metals (ppm)			Multi-Source Metals (ppm)					Additives (ppm)				
	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
54888	>2	>2	>2	>2	>2	>2	X	6	>2	>2	X	7	X	X	X	X	X	X	X	X


Sample ID	Contaminants					Physical Properties							
	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	Vindex	V40C Limit	V100C Limit	Visc Mode
54888	-	0.2	>0.1	-	>2.0	10.8	2.1	109	14.4	135	92 - 124	12.5 - 16.3	C

MARINE DIESEL SPECIALIST Phone: Email: Fax: - - -	Machine ID: ICE HEAR Machine Year : NA	Component ID: 066239954 Component Make: NORTHERN LIGHTS Component Model: M1066A Component Year: NA Component Type : DIESEL ENGINE Component Location: STARBOARD GENERATOR Sump Capacity: 5 Gallons	 MOTOR CHECK ANALYSIS CLINIC 2000 N FLORIDA MANGO RD SUITE 104 WEST PALM BEACH FL 33409 561-684-7799
	Component Description:		

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
54889	9/6/2024	14292	100	15W40	UNKNOWN	UNKNOWN	No	9/6/2024	
Comments	ALL ENGINE WEAR RATES NORMAL. SAMPLE APPEARS FREE OF EXTERNAL CONTAMINATION. ANALYSIS INDICATES PROPER PERFORMANCE OF THE LUBRICANT AND UNIT.								

Sample ID	Wear Metals(ppm)							Contaminant Metals (ppm)			Multi-Source Metals (ppm)					Additives (ppm)				
	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
54889	>2	>2	>2	>2	>2	>2	X	6	>2	>2	X	8	X	X	X	X	X	X	X	X


Sample ID	Contaminants					Physical Properties							
	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	Vindex	V40C Limit	V100C Limit	Visc Mode
54889	-	0.3	>0.1	-	>2.0	10.8	2.5	109	14.4	135	92 - 124	12.5 - 16.3	C

MARINE DIESEL SPECIALIST Phone: Email: Fax: - - -	Machine ID: ICE HEAR Machine Year : NA	Component ID: S0Y00712 Component Make: CATERPILLAR Component Model: 3512 Component Year: NA Component Type : DIESEL ENGINE Component Location: PORT MAIN Sump Capacity: 50 Gallons	 MOTOR CHECK ANALYSIS CLINIC 2000 N FLORIDA MANGO RD SUITE 104 WEST PALM BEACH FL 33409 561-684-7799
	Component Description:		

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
54890	9/6/2024	12195	150	15W40	UNKNOWN	UNKNOWN	No	9/6/2024	
Comments	ALL ENGINE WEAR RATES NORMAL. SAMPLE APPEARS FREE OF EXTERNAL CONTAMINATION. ANALYSIS INDICATES PROPER PERFORMANCE OF THE LUBRICANT AND UNIT.								

Sample ID	Wear Metals(ppm)							Contaminant Metals (ppm)			Multi-Source Metals (ppm)					Additives (ppm)				
	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
54890	<2	<2	<2	<2	<2	<2	X	5	<2	<2	X	3	X	X	X	X	X	X	X	X

Sample ID	Contaminants					Physical Properties							
	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	Vindex	V40C Limit	V100C Limit	Visc Mode
54890	-	0.4	>0.1	-	>2.0	9.5	4.3	109	14.4	135	92 - 124	12.5 - 16.3	C

MARINE DIESEL SPECIALIST Phone: Email: Fax: - - -	Machine ID: ICE HEAR Machine Year : NA	Component ID: 50Y00711 Component Make: CATERPILLAR Component Model: 3512 Component Year: NA Component Type : DIESEL ENGINE Component Location: STARBOARD MAIN Sump Capacity: 50 Gallons	 MOTOR CHECK ANALYSIS CLINIC 2000 N FLORIDA MANGO RD SUITE 104 WEST PALM BEACH FL 33409 561-684-7799
	Component Description:		

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
54891	9/6/2024	12168	150	15W40	UNKNOWN	UNKNOWN	No	9/6/2024	
Comments	ALL ENGINE WEAR RATES NORMAL. SAMPLE APPEARS FREE OF EXTERNAL CONTAMINATION. ANALYSIS INDICATES PROPER PERFORMANCE OF THE LUBRICANT AND UNIT.								

Sample ID	Wear Metals(ppm)							Contaminant Metals (ppm)			Multi-Source Metals (ppm)					Additives (ppm)				
	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
54891	<2	<2	<2	<2	<2	<2	X	5	<2	<2	X	<2	X	X	X	X	X	X	X	X

Sample ID	Contaminants					Physical Properties							
	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	Vindex	V40C Limit	V100C Limit	Visc Mode
54891	-	0.4	>0.1	-	>2.0	9.6	4.5	109	14.4	135	92 - 124	12.5 - 16.3	C

ABNORMAL

SEVERE

D = DETECTED

-- = NOT DETECTED

X = NOT TESTED / NOT APPLICABLE

NA = NOT AVAILABLE

C = CALCULATED

M = MEASURED

MARINE DIESEL SPECIALIST Phone: Email: Fax: - - -	Machine ID: ICE HEAR Machine Year : NA	Component ID: 52565 Component Make: REINTJES Component Model: WAV 840 BB Component Year: NA Component Type : GEARBOX Component Location: PORT Sump Capacity: 10 Gallons	MOTOR CHECK ANALYSIS CLINIC 2000 N FLORIDA MANGO RD SUITE 104 WEST PALM BEACH FL 33409 561-684-7799
Component Description:			

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
54892	9/6/2024	12195	100	SAE 40	UNKNOWN	UNKNOWN	No	9/6/2024	
Comments	GEAR UNIT WEAR RATES NORMAL. SAMPLE APPEARS FREE OF EXTERNAL CONTAMINATION. ANALYSIS INDICATES PROPER PERFORMANCE OF THE LUBRICANT AND UNIT.								

Sample ID	Wear Metals(ppm)							Contaminant Metals (ppm)			Multi-Source Metals (ppm)					Additives (ppm)				
	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
54892	<2	<2	2	13	54	>2	X	6	<2	>2	X	6	X	X	X	X	X	X	X	X

Sample ID	Contaminants				Physical Properties								
	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	Vindex	V40C Limit	V100C Limit	Visc Mode
54892	X	X	>0.1	-	X	X	3.0	158	14.4	87	133 - 181	12.5 - 16.3	C

MARINE DIESEL SPECIALIST Phone: Email: Fax: - - -	Machine ID: ICE HEAR Machine Year : NA	Component ID: 52566 Component Make: REINTJES Component Model: WAV840BB Component Year: NA Component Type : GEARBOX Component Location: STARBOARD Sump Capacity: 10 Gallons	MOTOR CHECK ANALYSIS CLINIC 2000 N FLORIDA MANGO RD SUITE 104 WEST PALM BEACH FL 33409 561-684-7799
Component Description:			

Sample ID	Date Taken	Hours on Component	Hours on Oil	Oil Weight	Oil Brand	Oil Type	Oil Changed	Date Analyzed	User Sample ID
54893	9/6/2024	12168	100	SAE 40	UNKNOWN	UNKNOWN	No	9/6/2024	
Comments	GEAR UNIT WEAR RATES NORMAL. SAMPLE APPEARS FREE OF EXTERNAL CONTAMINATION. ANALYSIS INDICATES PROPER PERFORMANCE OF THE LUBRICANT AND UNIT.								

Sample ID	Wear Metals(ppm)							Contaminant Metals (ppm)			Multi-Source Metals (ppm)					Additives (ppm)				
	Iron	Chromium	Aluminum	Copper	Lead	Tin	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Nickel	Manganese	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
54893	<2	<2	<2	9	35	<2	X	6	<2	<2	X	6	X	X	X	X	X	X	X	X

Sample ID	Contaminants				Physical Properties								
	Fuel	Soot	Water	Glycol	Nitration	TBN	Oxidation	V40C	V100C	Vindex	V40C Limit	V100C Limit	Visc Mode
54893	X	X	>0.1	-	X	X	3.3	158	14.4	87	133 - 181	12.5 - 16.3	C

M[✓]C™ UNDERSTANDING YOUR REPORT

ENGINES

ALUMINUM:	PISTONS, BEARINGS, HOUSINGS, THRUST WASHERS, BUSHINGS
CHROMIUM:	COMPRESSION RINGS, LOW FRICTION BEARINGS, LINERS, CHROMATE COOLING SYSTEM
COPPER:	BEARINGS, BUSHINGS, THRUST WASHERS, OIL COOLER, CLUTCHES, AND AN OIL ADDITIVE IN SOME GASOLINE ENGINE OILS.
IRON:	CRANKSHAFT, CYLINDERS, PISTONS, LINERS, BEARINGS, VALVE TRAIN
LEAD:	BEARINGS, CONTAMINATION FROM LEADED GASOLINE
TIN:	PISTON SKIRTS, BEARINGS, AND BUSHINGS.
SILICON:	AIRBORN DIRT, SEAL MATERIAL, GASKETS, USED IN SOME OIL ADDITIVES, SPRAY LUBRICANTS, WHEN FOUND WITH POTASSIUM INDICATES GLYCOL ISSUE
POTASSIUM:	INDICATION OF GLYCOL OR SALTWATER INTRUSION, ADDITIVE IN SOME OILS
SODIUM:	FOUND IN SOME OIL ADDITIVES, GLYCOL, ENVIRONMENTAL COMTAMINANT OR SALT WATER
WATER:	MEASURED IN % VOLUME, CAN BE INDICATION OF CONDENSATION, COOLING SYSTEM LEAK, OR OUTSIDE CONTAMINATION
GLYCOL:	MEASURED IN % VOLUME, IN THE FORMULATION OF MOST COMMERCIAL COOLANTS
OXIDATION:	THIS IS THE RESULTS OF OXYGEN IN THE AIR REACTING WITH THE OIL AT ELEVATED TEMPERATURES. THIS IS A NORMAL PROCESS AS THE OIL AGES. IF AN ENGINE IS OPERATED CONTINUOUSLY AT A HIGH TEMPERATURE FOR EXTENDED PERIODS, OR IF DRAIN INTERVAL IS OVER EXTENDED, OIL CHANGE IS RECOMMENDED.
NITRATION:	FORMED DURING COMBUSTION PROCESS, LEADS TO ACCELERATED OIL DETERIORATION.
SOOT:	NORMAL COMBUSTION BY PRODUCT OF DIESEL FUEL AND APPEARS AS CONTAMINANT IN THE OIL CAUSING AN INCREASE IN VISCOSITY. INDICATE AN INPROPER AIR/FUEL RATIO, DEFECTIVE AIR INTAKE, FAULTY INJECTORS, OR BLOW-BY
VISCOSITY:	CALCULATED MEASUREMENT OF THE OIL'S ABILITY TO FLOW AND LUBRICATE, INDICATES IF OIL IS TOO THICK OR THIN
TBN:	MEASUREMENT OF OIL'S ALKALINE BASE RESERVE, ADDITIVE IN OIL CAPABLE OF NEUTRALIZING ACIDIC CONTAMINANTS, WHEN TBN IS BELOW 3, IT IS AN INDICATION THE OIL IS NO LONGER SERVICEABLE
FUEL DILUTION:	MEASURED IN % VOLUME, CAN INDICATE FAULTY COMBUSTION, RICH AIR/FUEL MIXTURE WHEN PRESENT BETWEEN 2%-5%. INJECTOR PROPBLEM OR INTERNAL FUEL LINE LEAK IS TYPICALLY INDICATED WHEN FUEL IS DETECTED AT HIGH LEVELS

TRANSMISSIONS

TORQUE CONVERTER, THE CASE, THRUST WASHERS, HOUSINGS, GEAR AND VANE PUMPS
BALL AND ROLLER BEARINGS, ALLOY OF STEEL PARTS
CLUTCH PLATES, BRONZE BUSHINGS, OIL COOLER OXIDES, BRASS FITTINGS
GEARS, BEARINGS, SHAFTS, SOME CASES, CLUTCH PLATES
GEARS
SOME BEARING CAGES
AIRBORN DIRT, SEALERS, GASKETS, USED IN SOME OIL ADDITIVES, SPRAY LUBRICANTS, WHEN FOUND WITH POTASSIUM INDICATES GLYCOL ISSUE, SAND-CASTED PARTS
INDICATION OF GLYCOL OR SALTWATER INTRUSION, ADDITIVE IN SOME OILS
FOUND IN SOME OIL ADDITIVES, GLYCOL, ENVIRONMENTAL COMTAMINANT OR SALT WATER

ACCURACY OF RECOMMENDATIONS IS DEPENDENT ON THE REPRESENTATIVE OIL SAMPLES AND COMPLETELY CORRECT DATA ON BOTH UNIT AND OIL. THIS ANALYSIS IS INTENDED AS AN AID IN PREDICTING MECHANICAL WEAR. NO GUARANTEE, EXPRESS OR IMPLIED, IS MADE AGAINST FAILURE OF THIS COMPONENT, MOTOR CHECK(OIL LAB LLC.) LIABILITY IN ANY CASE IS LIMITED TO THE COST OF THE REPORTED ANALYSIS.